

Claims

1. A liquid fuel direct supply fuel cell system, in which a generator having a plurality of cells connected serially or in parallel, the cell in which an anode and a cathode are oppositely installed through a protonic conductive polymer electrolyte membrane and a liquid fuel and an oxidizing agent gas are each supplied to the anode and the cathode, a fuel tank storing a liquid fuel to be supplied to the anode, a high concentration fuel tank storing a high concentration fuel used for regulating a concentration of the liquid fuel in the fuel tank, and a water tank storing water produced by cell reaction of the generator, wherein
 - a sensor for yielding an output signal used for detecting the concentration of the liquid fuel having at least a temperature detector, and
 - a controller for operating at least one of a control of a supply of the high concentration fuel from the high concentration fuel tank to the fuel tank, the control of the supply of water from the water tank to the fuel tank, or the control of the supply of the liquid fuel from the fuel tank to the generator on the basis of the output signal from the sensor are installed.
2. The liquid fuel direct supply fuel cell system according to claim 1, wherein the sensor is installed integrally with the generator.
3. The liquid fuel direct supply fuel cell system, according to claim 2, wherein the sensor is constituted by the temperature detector, a membrane, and at least one electrode installed on a surface of the membrane.
4. The liquid fuel direct supply fuel cell system, according to claim 3, wherein:
 - a polymer electrolyte membrane having a protonic conductivity is used as the membrane;
 - a first electrode which receives the liquid fuel and a second electrode which receives an oxidizing agent gas, which are installed on both the surfaces of the membrane are used as the electrode;
 - a voltage across the first and second electrode and a temperature-indicating signal obtained by the temperature detector are used as the output signal from the sensor; and
 - the output signal is converted to the concentration of the liquid fuel in the controller.
5. The liquid fuel direct supply fuel cell system, according to claim 3, wherein:
 - a liquid permeating membrane to permeate the liquid fuel is used for the membrane;
 - an oxidation electrode comprising a catalysts for oxidizing the liquid fuel permeated through the membrane is used as the electrode;

the oxidizing agent gas is supplied to the oxidation electrode side to allow the liquid fuel, which is permeated through the membrane, to be oxidized by the oxidation electrode ;
the temperature-indicating signal obtained by the temperature detector is used as the output signal from the sensor; and

in the controller, the temperature-indicating signal is converted to the concentration of the liquid fuel.

6. The liquid fuel direct supply fuel cell system, according to claim 5, wherein:
the temperature-indicating signal is converted to a temperature changed by oxidization of the liquid fuel, which is permeated through the membrane, to be converted to the concentration of the liquid fuel.

7. The liquid fuel direct supply fuel cell system, according to claim 6, wherein:
in at least one of a position around a liquid fuel inlet of the generator or the position around a exhausted liquid fuel outlet of the generator, a second temperature detector is installed to detect a temperature around the position to know the change of the temperature on the basis of a difference between a signal of the temperature detector of the sensor and the signal of the second temperature detector.

8. The liquid fuel direct supply fuel cell system according to claim 1, wherein:
the sensor has a separator having a via hole for supplying and air outlet and the via hole for supplying and fuel outlet, and has the protonic conductive polymer electrolyte membrane, the anode, and the cathode which are installed between the separators;

each cell of the generator has the separator having the via hole for supplying and air outlet and the via hole for supplying and fuel outlet;

the sensor is arranged in a side for fuel inlet to the generator, the via hole for supplying and air outlet in the sensor is communicated to the via hole for supplying and air outlet in the generator, and the via hole for supplying and fuel outlet in the sensor is communicated to the via hole for supplying and fuel outlet in the generator.

9. The liquid fuel direct supply fuel cell system according to claim 8, wherein:
the generator has an anode side endplate and an anode side terminal plate in the one end of a plurality of cells and a cathode side endplate and a cathode side terminal plate in the other end;

the sensor is installed between the endplate and the terminal plate of the anode side.

10. The liquid fuel direct supply fuel cell system according to claim 8, wherein the temperature detector is mounted on an opposite plane of the protonic conductive polymer electrolyte membrane of the separator of the anode side of the sensor.

11. The liquid fuel direct supply fuel cell system according to claim 4, wherein fuel concentration decline is detected from an increase in an electromotive force across the first and second electrodes and a fuel concentration rise is detected from a decrease in the electromotive force.

12. The liquid fuel direct supply fuel cell system according to claim 11, wherein a means is installed for determine a slope of a change of the electromotive force at a start of operation.

13. The liquid fuel direct supply fuel cell system according to claim 12, wherein a means is installed for knowing the temperature of the generator and the fuel concentration is subjected to an open loop control separately from the electromotive force until the generator reaches a predetermined temperature at the start of operation.

14. A method for operation control, in which, for the liquid fuel direct supply fuel cell system, in which a generator having a plurality of cells connected serially or in parallel, the cell in which the anode and the cathode are oppositely installed through the protonic conductive polymer electrolyte membrane and the liquid fuel and the oxidizing agent gas are supplied to the anode and the cathode respectively, the fuel tank storing the liquid fuel to be supplied to the anode, the high concentration fuel tank storing a high concentration fuel used for regulating a concentration of the liquid fuel in the fuel tank, and the water tank storing water produced by cell reaction of the generator,

the sensor having at least the temperature detector and the controller are installed for detecting the concentration of the liquid fuel and

the controller works for at least one of the control of a supply of the high concentration fuel from the high concentration fuel tank to the fuel tank, the control of the supply of water from the water tank to the fuel tank, or the control of the supply of the liquid fuel from the fuel tank to the generator on the basis of the output signal from the sensor.

15. An operation control device, in which, for the liquid fuel direct supply fuel cell system, in which a generator having a plurality of cells connected serially or in parallel, the cell in which the anode and the cathode are oppositely installed through the protonic conductive

polymer electrolyte membrane and the liquid fuel and the oxidizing agent gas are supplied to the anode and the cathode respectively, the fuel tank storing the liquid fuel to be supplied to the cathode, the high concentration fuel tank storing a high concentration fuel used for regulating a concentration of the liquid fuel in the fuel tank, and the water tank storing water produced by cell reaction of the generator,

the sensor having at least the temperature detector and the controller are installed for detecting the concentration of the liquid fuel and

the controller works for at least one of the control of a supply of the high concentration fuel from the high concentration fuel tank to the fuel tank, the control of the supply of water from the water tank to the fuel tank, or the control of the supply of the liquid fuel from the fuel tank to the generator on the basis of the output signal from the sensor.